

# 21<sup>st</sup> Century Truck Partnership 2013 Fall Meeting Summary Report



Department of Energy  
Department of the Army



January 14, 2014

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## **ACKNOWLEDGEMENTS**

Medium- and heavy-duty vehicles serve as the backbone of America's economy, playing a vital role in moving freight and passengers. These trucks also perform essential duties in other parts of society, such as maintaining our electric power infrastructure, collecting refuse, and maintaining the highway system. Improving the vehicle efficiency of freight transportation is vital to helping the country decrease its petroleum use as the economy grows.

Leading the way, the 21st Century Truck Partnership (21CTP) addresses these important national challenges related to medium-duty and heavy-duty truck efficiency, safety, and emissions by pursuing collaborative research and development among government and industry partners. The overall vision of 21CTP is for the nation's trucks and buses to safely and cost-effectively move larger volumes of freight and greater numbers of passengers while emitting little or no pollution and dramatically reducing the dependency on foreign oil.

The 21CTP addresses the technical needs of the medium- and heavy-duty truck industry, as well as major policy goals for government agencies, through three main activities:

- Accelerate technology development through collaborative, pre-regulatory, and pre-competitive R&D projects (component and system-level), and provide access to research resources (expertise, laboratories, funding) for technology development.
- Focus R&D efforts on topics of broad interest by providing a discussion forum and organizing consensus building tools such as roadmaps and position papers that help Partnership members come to agreement on R&D topics and goals.
- Information exchange and dissemination through regular conference calls, meetings, and information dissemination tools. These resources help Partners access current information about industry and government activities and opportunities.

TARDEC's objectives for hosting the 21CTP Fall Meeting included:

- Developing greater awareness of the technical scope of activities, resources and facilities available at TARDEC.
- Developing connections with the Advanced Vehicle Power Technology Alliance (AVPTA), specifically to identify opportunities to expand the enterprise across broader Department of the Army (TACOM PEOs/PMs, RDECOM/ARDECs, etc.) and Inter-Agency engagements.
- Identify areas of mutual technical interest with the potential to lead to future TARDEC/DOE Vehicle Technologies Office (DOE-VTO) Jointly-Solicited Projects.

We sincerely thank COL Eric Fletcher, (Acting) Deputy Program Executive Officer, Tank Automotive Command (TACOM), Combat Support & Combat Service Support (CS&CSS) for providing the Warfighter's perspective of capabilities and functionalities required for future tactical trucks.

We also extend our personal thanks to the 21CTP Industry Partners, Executive Committee Members, Senior Executives, and Subject Matter Experts for their time, their willingness to share their expertise and whose collective contributions have made this a successful event.

We also recognize the 21CTP member companies that provided display vehicles, exhibits and hosts to enhance the meeting.

**Mr. Patrick Davis**

Director, Vehicle Technologies Office, Department of Energy-Energy Efficiency and Renewable Energy (DOE-EERE)

**Dr. Paul D. Rogers**

Director, U.S. Army Tank Automotive Research, Development and Engineering Center (TARDEC), U.S. Army Research Development and Engineering Command (RDECOM), U.S. Army Materiel Command (AMC)

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## **EXECUTIVE SUMMARY**

On Wednesday 6 November 2013, over 125 executive and technical experts from industry, government agencies, national laboratories and the military met in the Plenary Session of the DOE-VTO 21CTP Fall Meeting at TARDEC. The session was keynoted by Mr. Patrick Davis, Director, DOE-VTO; COL Eric Fletcher, (Acting) Deputy Program Executive Officer, TACOM CS&CSS; and Dr. Paul Rogers, Director, TARDEC.

The session kicked-off two days of Senior Executive and technical Subject Matter Expert (SME) discussions aimed at identifying areas of mutual interest leading towards future purposeful engagements. The meeting culminated with over 70 attendees, primarily SMEs, reviewing, discussing and compiling a list of 13 High-Level and 15 Sub-Topic areas of mutual technical interest that have strong potential to lead to collaboration among the major heavy/medium-duty truck manufacturers, DOE-VTO and TARDEC.

In addition to the technical sessions, TARDEC hosted tours of the Ground System Power & Energy Laboratory (GSPEL); and six of the 21CTP industry members provided vehicles and technical exhibits, most notably the SuperTruck demonstrator semi-tractor/trailer unit jointly-developed by Cummins, and Peterbilt.

The next steps include compiling the work product from the technical sessions, distributing the compiled information among the primary stakeholder SMEs, developing consensus on areas of mutual interest for collaboration, and then developing specific project implementation plans.

The meeting co-hosts, Mr. Davis and Dr. Rogers, concluded the event was very successful in attaining its primary goal of expanding the relationship between VTO, TARDEC and the 21CTP Community by facilitating point-to-point contact among Executives and respective SMEs, and that 21CTP provides a venue to expand collaboration between DOE and the Department of the Army.

## INTRODUCTION

Following the January 2013 Advanced Vehicle Power Technology Alliance (AVPTA) Second Quarter Fiscal Year 2013 Quarterly Executive Review Meeting (Q2FY13 QERM), a recommendation was made to the TARDEC Director to convene the Fall Meeting of the 21st Century Truck Partnership (21CTP) at the Detroit Arsenal in Warren, MI. The basis for the recommendation was that the scale and technical scope of the vehicles addressed by 21CTP align well with military vehicles, particularly medium- and heavy-duty tactical trucks. In the case of heavy-duty tactical trucks, there is a direct analog between the military M915 and the Freightliner semi-tractor from which it is derived. In May 2013, the TARDEC Director gave full and final approval to proceed with arrangements to convene the Fall Meeting at TARDEC.

To facilitate the meeting, two Planning and Implementation Teams (PITs) were chartered and populated. One PIT was TARDEC-internal and the other PIT was populated with representatives from DOE-VTO, TARDEC's National Automotive Center (NAC) and Industry Members of the 21CTP Executive Committee (ExCom). The TARDEC-internal PIT was populated with representatives from the G5 Communications/Outreach Office and the NAC which administers DOE-VTO collaboration activities (including AVPTA) on behalf of the Department of the Army (DA) and TARDEC. The DOE-VTO representatives to the other PIT were Mr. Ken Howden, Director, 21CTP and Mr. Michael Laughlin, Program Director, Energetics Inc. The PITs met weekly. NAC representatives also participated in the 21CTP Government Only and Full Partnership conference calls to prepare for the event.

The PITs collaborated to develop a unique, Three-Track Agenda (Appendices A through D) for Senior Executives, Technical Directors and technical Subject Matter Experts (SME), respectively to follow throughout the day-and-a-half meeting duration. The Agenda's key elements were a Plenary Session, Senior Executives Meeting Session, Laboratory Tour and Review of 21CTP Industry Partner-provided Display Vehicles and Exhibits, focused technical topic SME Discussion Sessions and a Second Day Session to Identify High-Level topics of mutual interest for follow-up. The output from the Executive and Technical Sessions are contained within the immediately following Summary section of this report.

## SUMMARY

### Executive Session:

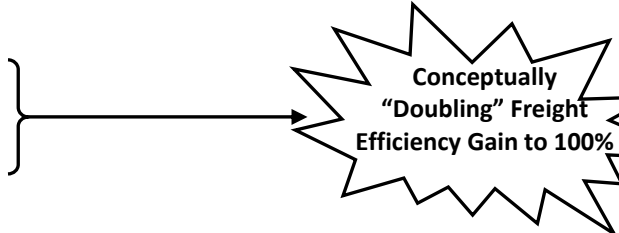
The Executive Session was co-chaired by Mr. Davis and Dr. Rogers. A complete list of Executive Session participants is contained within Appendix E. The session consisted of robust and wide-ranging topical discussions that preceded and followed a tour of the TARDEC Ground System Power & Energy Laboratory (GSPEL) and a review of the 21CTP Industry Partner-provided Display Vehicles and Exhibits. A list of display vehicles is provided within Appendix F. Within the GSPEL, the executives were briefed by key personnel during stops at the Air Filtration, Calorimeter, Power & Energy Vehicle Environment (PEVEL), Fuel Cell, Electric Components and Energy Storage Laboratories; most of which are unique in capability, capacity and functionality. Many of the labs are available for industry testing under Test Service Agreements (TSAs) and/or Cooperative Research and Development Agreements (CRADAs).

The Key Topics captured during the Executive Session follow:

- Military Vehicle Requirements & Specifications
  - Change from “Go Fast to Go Slow” to “Go Slow to Go Fast”
- Diagnostics/Prognostics
  - How does the commercial trucking industry Capture & Rationalize Data?
  - What’s the approach to Pre-emptive (Condition-Based) Maintenance?
    - Effect on Missions Readiness/Completion?
    - Effect on secondary component failures and potential system capability/functionality degradation?
- How can the Military make vehicle systems “Flexible” to “Shed” and/or “Add” technologies as Requirements change/evolve?
- Exportable Power
  - “Value” is perceived differently between the Commercial and Military Sectors
    - The Commercial Sector currently perceives little “Value” in exportable power
    - The Military Sector perceives there’s “Value” in exportable power in:
      - Mission Flexibility
      - Durability
      - Extended Force Projection “Reach”
      - Reduced Logistics Burden

- Vehicle Electrification
  - There are three, Price Point Driven implementation stages for the Military:
    - 1) High Amperage Alternators
    - 2) Auxiliary Power Supplies & Integrated Starter/Generators
    - 3) Series Propulsion
- There is strong mutual interest in quantifying the “Delta” between Commercial and Military Sector:
  - Total Cost of Ownership vs.
  - Life-Cycle Cost
    - How can the Military rationalize the cost effects of “Intangibles” such as “Disaster Relief” operations?
- Autonomy & Autonomy-Enabled Vehicles
  - The Military has a Two Phase approach to implementation
    - 1) Leader/Follower
    - 2) Fully Autonomous
  - The Military will pursue a Measured Introduction of Capability
  - Military “Limitations” include:
    - User Acceptance
    - Safety/Liability
    - Military Requirements Documentation/Doctrine
    - Endurance (Mission Liability)
- How can the Commercial Sector become aware of TARDEC opportunities?
  - Broad Agency (BAA), Small Business Innovative Research (SBIR) and Small Business Technology Transfer (STTR) Announcements within FedBizOps
  - Department of Energy Vehicle Technologies Office Funding Opportunity Announcements contain DOE-VTO/TARDEC joint-solicitations within FedBizOps and the DOE website.
  - Direct Engagement w/ TARDEC Leadership
  - Direct Engagement w/ TARDEC Subject Matter Experts
  - CRADAs
  - Electronic & Hard Copy Publications including:
    - “Accelerate”
    - “2013 Capabilities Handbook”
  - Ground Vehicle Gateway

- Industry Days
  - TARDEC shares future Targets, and
  - Partnering Opportunities
- What are some of the U.S. Military “Over-Match” areas?
  - Protected Mobility
  - Information Domination
    - Situational Awareness/Off-Site Threat Awareness
  - Autonomy-Enabled Systems
  - Reducing the Logistics Burden, Footprint and Tail
  - Smaller Systems Projecting Lethality
- TARDEC’s Approach to Open Architecture
  - VICTORY: establishes standards
  - VECTOR: develops the physical architecture
- Operational Energy Reference Documents
  - “Operational Energy Initial Capabilities”
  - “DoD’s Operational Energy Strategy”
  - Available at: <http://energy.defense.gov>
- “Sweet Spot” for Future Opportunities
  - High Mobility Multipurpose Wheeled Vehicle (HMMWV) and other vehicles either within Sustainment or entering into Sustainment
    - How does the Military keep those vehicles “Viable” and “Current” for another 25 to 30 years of service?
- Going forward the Military will take a “Holistic” approach to its Ground Vehicle Fleet.
  - It will develop and integrate common, cross-platform technologies.
- DOE-VTO Interest Areas:
  - Vehicle Electrification (Primarily Light Duty)
  - Energy Storage
    - Advanced Batteries
      - What’s beyond Li-Ion?
      - How to attain \$125/kWh?
        - Currently at approximately \$250-\$300/kWh
  - Power Electronics (Developing a Domestic Manufacturing Infrastructure)
  - Wide Band-Gap Semi-Conductors
  - Non-Rare-Earth Magnets/Motors

- Engines
    - Low Temperature Combustion
    - Dual-Fuel Capability
  - Light-Weight Materials
    - Al, Mg, Advanced High-Strength Steels (AHSSs), Long-Fiber Carbon Composites, etc.
    - Dissimilar Material Joining
  - Robust Bio-Fuels
  - Heavy-Duty Vehicles
    - SuperTruck II
      - Develop/Define
        - Goals
        - Metrics
        - Specifications
- 
- Advanced Vehicle Power Technology Alliance (AVPTA)
    - Autonomy (Light-Duty vs. Heavy-Duty Application Benefits)
      - Will Autonomy-Enabled Light-Duty vehicles accumulate more miles and fuel because passengers will be more tolerant of longer commutes and drives?
      - There's interest in quantifying the metrics difference among and between the Commercial and Military, Light- and Heavy-Duty Sectors.
  - Vehicle-To-Grid (V2G)
    - There's interest in conducting Business Case Analyses:
      - Commercial vs. Military "Benefits"
    - There's potential interest in conducting an Industry/Military Workshop.

Technical Sessions:

Four (4) Technical Sessions convened during the meeting. Three (3) SME Discussion Sessions convened on Day 1, and a down-select consolidation meeting convened on Day 2. Lists of the 21CTP Industry Member, DOE, and Other Government Agency Technical Directors and SME names are contained within Appendix G. The SME Discussion Sessions each focused on one or more technical topic areas that were reduced from an original list containing 32 candidates. The respective SME Discussion Session, (Topics) and Industry Lead/Affiliation are:

- Session 1 (Vehicle Electrification & Autonomous Vehicles)
  - Industry Lead: Dr. Mihai Dorobantu, Eaton Corporation
- Session 2 (Powertrains, Fuels/Lubricants, & Open Architectures)
  - Industry Lead: Mr. Paul Miller, Cummins, Inc.
- Session 3 (Operational Energy, Fuel Efficiency, Light-Weighting & Vehicle System Design)
  - Industry Lead: Mr. Skip Yeakel, Volvo Trucks North America

The Down-select Consolidation Session consisted of an overview of the above-listed Day 1 Executive Session Key Topics, 21CTP SuperTruck demonstrator vehicle project overviews by respective Industry Member representatives, and an open discussion on aligning and compiling the work product generated on Day 1 by each of the above-listed Groups. The work product from the Day 2 Consolidation Session is compiled within the following list of High-Level and Sub-Topics of Mutual Interest:

- Session 1 (Vehicle Electrification & Autonomous Vehicles)
  - Modular high voltage power management
    - Standardized high voltage DC bus
    - Open architectures
    - Enabler for Vehicle-to-Grid (V2G)
  - Component level hybridization options for light-duty and medium-duty commercial vehicles
    - Battery standardization
    - Wireless charging for plug-in vehicles

- Session 2 (Powertrains, Fuels & Lubes, Open Architectures)
  - Standardized On-Board Diagnostics (OBD)
    - Use of OBD technologies for prognostics and diagnostics
  - Deep powertrain integration
    - Efficiency improvements
    - Commercial versus military considerations/technologies
  - Lowest viscosity and other properties of oils and other lubricants
  - Waste heat recovery for no-idle/silent watch capabilities
    - Thermoelectric, mechanical, other solutions
- Session 3 (Operational Energy, Fuel Efficiency, Light-Weighting, Vehicle System Design)
  - Multi-material joining
  - Truck efficiency considerations
    - Single operator platooning
    - Efficiency metrics (weight versus volume)
    - Use assistive technologies to implement high efficiency vehicle configurations (size and weight study from Department of Transportation, applicability to military)
- Availability of Vehicle-to-External (V2X) real-time data for optimization
- Low rolling resistance tires
  - Military versus commercial – areas of commonality and differences
- Open source modeling
  - Common language for translating proprietary model results for public discussion
  - Potential AVPTA project opportunity for Work Group 7 – Analytical Tools
- V2G – Hybrid vehicle power source
  - Alternative fuels, especially natural gas

## **CONCLUSIONS, RECOMMENDATION & NEXT STEPS**

### **Conclusions:**

- The meeting was well-attended, with broad executive and technical personnel representation of the 21CTP Industry Partners, DOE-VTO and National Laboratories, the US Army, and Other Government Agencies. General feedback about the meeting is provided below. The meeting:
  - Provided insight into the military's technical barriers, needs and ongoing/future activities,
  - Resulted in the identification of a significant number of High-Level and Sub-Topic Areas of Mutual Interest, and
  - Helped lay the foundation for future engagements among and between the 21CTP Industry Partners, DOE-VTO and TARDEC.
- The Executive Session discussions were robust and wide-ranging. They opened paths for continuing dialogue and purposeful engagement among and between the 21CTP stakeholders and TARDEC.
- The GSPEL tour was valuable to identify it as a test service resource containing unique capabilities available to industry.
- The vehicle displays and exhibits were valuable to US Military personnel to provide reference to current, state-of-the-art technologies contained within commercial and advanced technology demonstrator vehicles.

### **Recommendations:**

- TARDEC perspective:
  - Continue and expand its participation in 21CTP including contributing to influence and frame the scope of the Areas of Interest for future technical activities, and
  - Cultivate contacts within the 21CTP stakeholders to identify specific future collaboration opportunities.

Next Steps:

- Develop a nominal one paragraph technical description/scope for each of the above-listed High-Level and Sub-Topics of Mutual Interest.
- Distribute the expanded High-Level and Sub-Topics of Mutual Interest among the meeting participants and identify SMEs from the respective stakeholders.
- Convene preliminary conference calls with the above-referenced SMEs as a prelude to developing stakeholder consensus on which topics will continue to be pursued near-term, deferred to a later time or dropped from future consideration. Including which topics align with the AVPTA-chartered technical focus areas.
- Fully develop inputs to potential scopes of work, broad funding estimates, and collaboration engagement plans for each of the topics to be pursued in the mid-to long-term.
- Conduct follow-ups between TARDEC and the 21CTP Industry Partners to determine interest in point-to-point engagement opportunities for alignment with the “TARDEC Strategy”.
- TARDEC participates in the upcoming National Academies of Science Review Board assessment of 21CTP. Tentatively scheduled for early March 2014.
- NAC represents TARDEC remaining engaged with 21CTP via direct contact with VTO’s 21CTP Director and participation in the Partnership’s Government Only and Full Partnership regularly-scheduled conference calls.

## Appendix A

### 3-Track Agenda for 21st Century Truck Partnership Fall Meeting (21CTP-FM)

		Wed 6 Nov AM				Wed 6 Nov PM					Thu 7 Nov AM			
Agenda Track	Participants / Activity	Plenary Session	Break #1	SMEs' GSPEL Tour & Vehicle/ Exhibit Reviews	SME Discussion Session (Group 1)	SME Discussion Session (Group 2) & Working Lunch	SME Discussion Session (Group 3)	Break #2	Conclude & Summarize SME Discussion Sessions	SME Discussion Sessions Summary Overviews & Wrap-up	21CTP Gen 2 Overview Briefing	Review SME Groups' Work Product from Wednesday	Down-Select High Priority/Pay off Topics	Develop Detailed Next Steps Implementation Plan
1	Technical Directors													
2	Subject Matter Experts (SMEs)													
	Participants / Activity	Plenary Session	Break #1	Senior Executives' Meeting	Senior Executives' GSPEL Tour & Vehicle/ Exhibit Reviews	Continue Senior Executives' Meeting & Working Lunch	AVPTA Executive Review Meeting*	Open	SME Discussion Sessions Summary Overviews & Wrap-up					
3	Senior Executives													

\* Mr. Davis, Dr. Rogers and their respective support staff only.

Opt Out Opportunities

Ajourn

## Appendix B

	<b>21<sup>st</sup> Century Truck Partnership (21CTP) Fall Meeting Agenda</b>		
<p style="text-align: center;"><b><u>PROJECT OFFICERS</u></b></p> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p><b>Mr. Scott Schramm</b> Senior Engineer TARDEC-NAC Tel: (586) 282-4122 BB: (586) 306-4365</p> </div> <div style="width: 45%;"> <p><b>Ms. Stacy Mills</b> Special Projects Officer TARDEC-NAC Tel: (586) 282-7221 BB: (586) 524-1153</p> </div> </div>		<p style="text-align: center;"><b><u>LOCATION</u></b></p> <p>Detroit Arsenal Building 200A Auditorium &amp; TARDEC-U. Building 212B</p>	<p style="text-align: center;"><b><u>PARTICIPANTS</u></b></p> <p>Mr. Pat Davis COL Eric Fletcher Dr. Paul Rogers Mr. Kevin Mills 21CTP Members</p>

### Senior Executives Track 3

#### **Wednesday 6 November:**

#### **0800 – 0945 Plenary Session: Welcome, Organization Overviews, Briefings & Introductions**

- Mr. David Taylor – TARDEC Chief of Staff (“Emcee”)
  - Welcome & Detroit Arsenal/TARDEC History
- COL Eric Fletcher – (Acting) Deputy Program Executive Officer, CS&CSS
  - Combat Support & Combat Services Support (CS&CSS) Overview
  - Warfighter’s Tactical Ground Vehicle Capabilities/Functionalities Needs/Wants Briefing
- Dr. Paul Rogers – Director, TARDEC
  - RDECOM/TARDEC Overview
  - “TARDEC Strategy” High-Level Briefing
    - Return to Innovation
    - Strategy Key Concepts/Objectives  
{Purposeful: Engagements, Investments & Management}
    - Challenges
  - Event Expected Outcomes
- Mr. Kevin Mills – Associate Director, TARDEC Ground Domain Planning & Integration
  - “TARDEC Strategy” Mid-Level Briefing
    - TARDEC Identified Gaps in Areas of Mutual Technical Interest  
{Autonomous / Robotic Vehicles, Open Architectures, Diagnostics / Prognostics, Powertrains, Light-Weighting, Fuels / Lubricants, Operational Energy / Fuel Efficiency, and Vehicle Electrification}.

- Mr. Pat Davis – Director, DOE Vehicle Technologies Office (DOE-VTO)
  - DOE-VTO Overview
  - DOE-VTO/TARDEC Engagement Opportunities
    - 21CTP & SuperTruck
    - AVPTA
    - Incubator
  - Relationship Building/Expansion
- Mr. Ken Howden, Director, 21<sup>st</sup> Century Truck Partnership (21CTP)
  - 21CTP Program Overview
  - Vehicle Display & Exhibits Overview
  - Detailed Agenda Review
  - Introductions of Industry Lead for each Technical Group
- Mr. David Taylor, TARDEC Chief of Staff
  - Facility Tour and Executive Meeting Host Introductions
  - Pre-Break Announcements

**0945 – 1000 Break #1**

**1000 – 1100 Senior Executives Meeting**

- Mr. Davis, Dr. Rogers, COL Fletcher (if available), TARDEC Executive Directors (2), TARDEC Chief Scientist and 21CTP Industry Partner Senior Executives (10)

**1100 – 1200 Senior Executives Facilitated Tour**

- Ground Systems Power & Energy Laboratory (GSPEL)
- Commercial & Military Vehicle Displays
- 21CTP Industry Partner Exhibits

**1200 – 1300 Working Lunch – Continue/Conclude Senior Executives Meeting**

**1300 – TBD Advanced Vehicle Power Technology Alliance Executive Review Meeting**

- Mr. Davis, Dr. Rogers and respective support staff only.

**TBD – 1600 Open**

**1600 – 1700 Subject Matter Expert Discussion Sessions Summary Overview Briefings to Executives & Wrap-up**

**1700 Adjourn**

## Appendix C

	<b>21<sup>st</sup> Century Truck Partnership (21CTP) Fall Meeting Agenda</b>		
<p style="text-align: center;"><b><u>PROJECT OFFICERS</u></b></p> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <b>Mr. Scott Schramm</b>  Senior Engineer  TARDEC-NAC  Tel: (586) 282-4122  BB: (586) 306-4365 </div> <div style="width: 45%;"> <b>Ms. Stacy Mills</b>  Special Projects Officer  TARDEC-NAC  Tel: (586) 282-7221  BB: (586) 524-1153 </div> </div>		<p style="text-align: center;"><b><u>LOCATION</u></b></p> <p style="text-align: center;">Detroit Arsenal  Building 200A  Auditorium &amp;  TARDEC-U.  Building 212B</p>	<p style="text-align: center;"><b><u>PARTICIPANTS</u></b></p> <p style="text-align: center;">Mr. Pat Davis  COL Eric Fletcher  Dr. Paul Rogers  Mr. Kevin Mills  21CTP Members</p>

### Technical Directors & Subject Matter Experts (SMEs) Tracks 1 & 2

#### **Wednesday 6 November:**

#### **0800 – 0945 Plenary Session: Welcome, Organization Overviews, Briefings & Introductions**

- Mr. David Taylor – TARDEC Chief of Staff (“Emcee”)
  - Welcome & Detroit Arsenal/TARDEC History
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  - Warfighter’s Tactical Ground Vehicle Capabilities/Functionalities Needs/Wants Briefing
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    - Strategy Key Concepts/Objectives  
{Purposeful: Engagements, Investments & Management}
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  - Event Expected Outcomes
- Mr. Kevin Mills – Associate Director, TARDEC Ground Domain Planning & Integration
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    - TARDEC Identified Gaps in Areas of Mutual Technical Interest  
{Autonomous / Robotic Vehicles, Open Architectures, Diagnostics / Prognostics, Powertrains, Light-Weighting, Fuels / Lubricants, Operational Energy / Fuel Efficiency, and Vehicle Electrification}.

- Mr. Pat Davis – Director, DOE Vehicle Technologies Office (DOE-VTO)
  - DOE-VTO Overview
  - DOE-VTO/TARDEC Engagement Opportunities
    - 21CTP & SuperTruck
    - AVPTA
    - Incubator
  - Relationship Building/Expansion
- Mr. Ken Howden, Director, 21<sup>st</sup> Century Truck Partnership (21CTP)
  - 21CTP Program Overview
  - Vehicle Display & Exhibits Overview
  - Detailed Agenda Review
  - Introductions of Industry Lead for each Technical Group
- Mr. David Taylor, TARDEC Chief of Staff
  - Facility Tour and Executive Meeting Host Introductions
  - Pre-Break Announcements

**0945 – 1000 Break #1**

**1000 – 1100 Facility Tour, Vehicle Displays and Technology Exhibits**

- Ground Systems Power & Energy Laboratory (GSPEL)
- Commercial & Military Vehicle Displays
- 21CTP Industry Partner Exhibits

**1100 – 1200 Subject Matter Expert Discussion: Vehicle Electrification & Autonomous Vehicles**

- Mr. Alan Korn, Director, Meritor Advanced Brake System Integration
  - Active Safety Systems: Road to Autonomous Functionality
- Dr. Mihai Dorobantu, Director, Eaton Corporation Technology Planning & Government Affairs
  - Powertrain Efficiency Trends

**1200 – 1230 Lunch**

**1230 – 1330 Subject Matter Expert Discussion: Powertrains, Fuels/Lubricants, Open Architectures & Diagnostics/Prognostics**

- Dr. Wayne Eckerle, Vice President, Cummins Research & Technology
  - Heavy-Duty Diesel Engine Performance & Efficiency
  - Fuels & Lubricants
- Mr. Kevin Siskin, Manager, Daimler Trucks North America Engine Performance
  - On-Board Diagnostics (OBD) Considerations

**1330 – 1445 Subject Matter Expert Discussion: Operational Energy, Fuel Efficiency, Light-Weighting & Vehicle System Design**

- Mr. Sam McLaughlin, Manager, Volvo External Research North America Region with Mr. Skip Yeakel, Principal Engineer, Volvo Advanced Engineering
  - Vehicle Fuel Efficiency
- Dr. Vivek Sujan, Technical Advisor – Advanced Systems Integration, Cummins Inc.
  - Role of Vehicle Modeling

**1445 – 1500 Break #3**

**1500 – 1600 Conclude & Summarize Subject Matter Expert Discussion Sessions**

**1600 – 1700 Subject Matter Expert Discussion Sessions Summary Overview Briefings to Executives & Wrap-up**

**1700 Adjourn**

## Appendix D

	<b>21<sup>st</sup> Century Truck Partnership (21CTP) Fall Meeting Agenda</b>		
<p style="text-align: center;"><b><u>PROJECT OFFICERS</u></b></p> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <b>Mr. Scott Schramm</b>  Senior Engineer  TARDEC-NAC  Tel: (586) 282-4122  BB: (586) 306-4365 </div> <div style="width: 45%;"> <b>Ms. Stacy Mills</b>  Special Projects Officer  TARDEC-NAC  Tel: (586) 282-7221  BB: (586) 524-1153 </div> </div>		<p style="text-align: center;"><b><u>LOCATION</u></b></p> <p style="text-align: center;">Detroit Arsenal  Building 200A  Auditorium &amp;  Building 212B</p>	<p style="text-align: center;"><b><u>PARTICIPANTS</u></b></p> <p style="text-align: center;">Mr. Pat Davis  COL Eric Fletcher  Dr. Paul Rogers  Mr. Kevin Mills  21CTP Members</p>

### Technical Directors & Subject Matter Experts (SMEs) Tracks 1 & 2

#### **Thursday 7 November:**

- 0800 – 0900** Review of the SME Teams work product developed on Wednesday and down-select top five (5) high priority/payoff topics applicable to medium- and heavy-duty commercial and military vehicles of mutual interest to DOE-VTO, TARDEC and the 21CTP Industry Partners.
- Mr. Scott Schramm, Senior Engineer, TARDEC-NAC
- 0900 – 1000** SuperTruck Team Overview Presentations
- Cummins/Peterbilt (Paul Miller)
  - Daimler (Kevin Sissen)
  - Navistar (Dion van Leeve)
  - Volvo (Skip Yeakel)
- 1000 – 1015** Beyond SuperTruck; DOE Program Goals and Objectives
- Roland Gravel, Technology Development Manager for SuperTruck
- 1015 – 1100** Beyond SuperTruck; Partnership Technical Goals and Objectives
- 1100 – 1200** Medium-Duty Technical Discussion
- 1200** Adjourn

## Appendix E

### Executive Session Participants

<b>Allison Transmission</b>	Laurie Tuttle (Vice-President, Hybrid Programs)
<b>Cummins Inc.</b>	Dr. Wayne Eckerle (Vice-President, Corporate Research & Technology) Dion Anglin (Director, North/South American Defense Marketing)
<b>Daimler Trucks North America</b>	Craig Savonen (Director, Powertrain Applications) Sean Murphy (Director, Government Sales)
<b>Eaton Corporation</b>	Tom Stover (Vice President and Chief Technology Officer, Vehicle Group) Dr. Chris Herbst (Vice-President, Government Programs, Corporate) Dr. Mihai Dorobantu (Director, Technology Planning & Government Affairs) LTG (R) Robert Wilson, Segment Director, Corporate
<b>Meritor WABCO</b>	Alan Korn (Director, Advanced Brake System Integration)
<b>Navistar</b>	Russell Zukouski (Director, Advanced Technologies & Global Innovation)
<b>Oshkosh</b>	Gary Schmiedel (Executive Vice President, Technology) Chris Yakes (Vice President, Global Technology Engineering)
<b>DOE</b>	Pat Davis (Director, Vehicle Technologies Office)
<b>CASCOM</b>	COL Bruce McPeak (Director of Materiel Systems)
<b>TARDEC</b>	Dr. Paul Rogers (Director) David Taylor (Chief of Staff) Jennifer Hitchcock (Executive Director, Research, Technology & Integration) Dr. David Gorsich (Chief Scientist) Ken Ciarelli (Deputy Executive Director, Research, Technology & Integration) Chuck Coutteau (Deputy Executive Director, Systems Integration & Engineering)

## Appendix F

### 21CTP Meeting Display Vehicles & Exhibits

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#### **Cummins**

ATLAS Demonstration Vehicle (Nissan 1/2 ton pickup) - Full Size 1/2 ton Pickup Truck

ATLAS 2.8 liter model engine - ~ 3' x 3' floor stand with model engine

SuperTruck Demonstration Class 8 Tractor and Trailer

#### **Daimler**

Class 8 Tractor for comparison with M915 military derivative

#### **Eaton**

Light-duty hybrid vehicle

Medium-duty hybrid vehicle

Flexible HVDC electrical distribution system (will need table for this display, but will not need additional electrical or other logistics support)

#### **Meritor**

Drivetrain control and tire inflation interactive display

#### **Volvo Trucks**

SuperTruck video display

## Appendix G

### Industry Subject-Matter-Experts

<b>Allison Transmission</b>	Jerry Monette (National Accounts Manager, OEM and National Accounts) Richard Theis (Program Director, Advanced Hybrids) David Laverdiere (Director, Defense Programs)
<b>Cummins Inc.</b>	Paul Miller (Director, Research & Technology - External Relations) Dave Koeberlein (Director, SuperTruck Principle Investigator) Michael Ruth (Director-Technical Project Leader, Advanced Light Duty) Dr. Vivek Sujun (Technical Advisor - Advanced Systems Integration)
<b>Daimler Trucks North America</b>	Kevin Sisken (Manager, Technology Programs and Benchmarking) Terry Bruster (Program Manager, Military Vehicles)
<b>Eaton Corporation</b>	Christopher Hess (Director, Public Affairs, Corporate) Dr. Ankur Ganguli (Director, Controls, Systems, and Solutions, Corporate Research) Matthew Nolan (Senior Product Manager, Controls and Power Conversion) Dr. Alaa Elmoursi (Senior Technology Manager, Materials & Processing Technology, Corporate Research)
<b>Meritor Inc.</b>	Christopher Keeney (Senior Principal Engineer, Mobility Systems) Tracey Tradii (Program Manager, Government Funding Projects-Engineering) James Keane (Global Electronics Product Strategy)
<b>Navistar</b>	Dion Van Leeve (Chief Engineer-Electric Vehicle) Walter J. Budd (Chief Engineer, Advanced Technologies) John Dziuba (Chief Engineer)
<b>Oshkosh</b>	Nader Nasr (Director, Global Technology Engineering)
<b>PACCAR</b>	Ken Damon (Senior Project Engineer)
<b>Volvo Trucks North America</b>	Skip Yeakel (Principal Engineer, Advanced Engineering) Sam McLaughlin (External Research Manager, North American Region)

## **Government Agency Subject-Matter-Experts**

### **U.S. Department of Energy**

Ken Howden (Director, 21CTP)  
Roland Gravel  
Brian Cunningham

### **U.S. Environmental Protection Agency**

Houshun Zhang (Environmental Engineer)  
Angela Cullen (Environmental Engineer)  
Dennis Johnson (Director, Technology Assessment Center)  
Sam Waltzer (SmartWay Technology Team Leader)  
John Kargul (Senior Policy Advisor)

### **Argonne National Laboratory**

Glenn Keller (Team Leader, Vehicle Testing Activities)

### **National Renewable Energy Laboratory**

Kevin Walkowicz (Advanced Vehicle Testing Activity)

### **Oak Ridge National Laboratory**

Keith Kahl (Group Leader, Vehicle Systems Research)  
Dr. Ray Boeman (Program Director, Energy Partnerships)

### **Pacific Northwest National Laboratory**

Dr. George Muntean (Director of Transportation Programs)

### **Sandia National Laboratories**

Dr. Mark Musculus

### **Supporting Organizations for 21CTP (Energetics)**

Thomas Perrot (Vice-President, Technology Services Division)  
Michael Laughlin (Program Director, Partnerships & Market Transformation)  
Terry Levinson (Senior Analyst)